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ABSTRACT

The Water in Africa Project was realized over a 2-year period by a team of Peace Corps volunteers, World Wise Schools (WWS) classroom teachers, and WWS staff members. As part of an expanded, detailed design, resources were collected from over 90 volunteers serving in African countries, photos and stories were prepared, and standards-based learning units were created for K-12 students. Intended for middle school students, this unit can be used in geography, health, and language arts classrooms. Four or five 45-minute class periods are suggested. The unit focuses on Lesotho, a small landlocked country located within the country of South Africa. Two-thirds of the country is filled with steep, treeless mountains, and most of the population lives in the lowlands. Droughts have altered living and health conditions causing the women and girls (who do most of the water gathering) to travel farther and farther each day during the dry season for water. In the unit, students simulate village "water committees" that plan, design, and build a water supply system. Water committees are provided with a water project scenario, maps, and background information. Each committee presents its plan to the villagers to persuade them that their plan will increase the availability of water and the overall health of the village. The unit lists materials needed, outlines applicable standards, poses discussion questions, and lists student objectives. It details day-by-day procedures for the teacher and suggests assessment and follow-up/enrichment activities. (BT)

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Water in Africa

Bringing Water to a Lesotho Village: A Classroom Simulation

http://www.peacecorps.gov/wws/water/africa/lessons/

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Water in Africa is a project of Peace Corps World Wise Schools.

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Funded through a grant from the Department of Education, the Water in Africa project was realized over a two year period by a team of Peace Corps Volunteers, World Wise Schools' (WWS) classroom teachers, and WWS staff members. Inspired by an idea of one creative WWS teacher, the project eventually expanded into a detailed design. The development and implementation of the design included the collection of resources from over 90 Volunteers serving in African countries, the preparation of those photos and stories, and the creation of standards-based learning units for K-12 students.

Bringing Water to a Lesotho Village A Classroom Simulation

Description:

Lesotho is a small landlocked country located within the country of South Africa. Two-thirds of the country is filled with steep, treeless mountains. Most of the population lives in the lowlands. Droughts have altered living and health conditions causing the women and girls (who do most of the water gathering) to travel farther and farther each day during the dry season for water. In this lesson, students simulate village water committees that plan, design, and build a water supply system. Village committees are provided with a water project scenario, maps, and background information. Each committee presents its plan to the village to persuade them that their plan will increase the availability of water and the over-all health of the village.

Timeframe: Four or five 45 minute classroom periods

Curricular Areas: Geography
Health
Language Arts

Grade Level: Grades 6 - 8

Materials

- Classroom Internet access to Water in Africa link
- The Village Water Committee (one copy for each student)
- VWC Research and Design Guide (one copy for each group)
- Water Supply Provision Process (one copy for each student)
- Examples of Water Acquisition Systems (one copy for each student)
- Evaluation Rubric
- Maps of Lesotho
- Topographic map of Lesotho (attached but can also be found at URL www.peacecorps.gov/wws/guides/lesotho/images/lesking.gif)
- Background information about Lesotho found at URL www.peacecorps.gov/wws/guides/lesotho/overview.html
- Drawing paper, markers (for paper models) or clay, straws, aquarium gravel, poster board (for 3-models)

Standards

Geography Standard 14- Understands how human actions modify the physical environment

Benchmark-- Understands the ways in which human-induced changes in the physical environment in one place can cause changes in other places

Geography Standard 15- Understands how physical systems affect human systems Knows

the ways in which humansystems develop in response to conditions in the physical environment

Health Standard 2- Knows environmental and external factors that affect individual and community

Benchmark-- Knows cultural beliefs, socioeconomic considerations, and other environmental factors within a community that influence the health of its members

Language Arts Standard 4- Gathers and uses information for research purposes

Benchmark-- Uses a variety of resource materials to gather information for research topics

Benchmark-- information and ideas from multiple sources in systematic ways

Essential Questions

How do communities acquire water sources?

Is the health of a community affected by availability of water?

Objectives

- Students will compare and contrast rural and urban water supply systems.
- Students will assume a cooperative role in the simulation of a Village Water Committee.
- Students will interpret vignettes, photographs and descriptions of water supply systems used in Lesotho, Africa, and apply them to the simulation.
- Students will identify and describe how water could be supplied to the simulated community.
- Students will plan and design a water supply system for the simulated Lesotho village.
- Students will give an oral presentation to a peer group about the feasibility of their plan.

Procedure

Procedure: Day One

1. Begin lesson by asking students to respond to the first essential question, "How do communities acquire water sources?" Begin a class discussion on how the students' community gets the water that they use each day. Have students compose a list of their community's methods of water acquisition, examples might be community water tank, surface water from a nearby river, etc. Ask if this process is identical in all communities.

2. Direct students to create a Venn Diagram, over one circle write the word Rural over the other circle write the word Urban. Have students work with a partner to fill in the

diagram as best as they can, including the area in the middle, where the methods are the same. Share responses with the class.

3. Next, ask them to cross out the word rural, and urban and replace them with our community instead of urban and Lesotho, Africa instead of rural. Would there be any differences in the Venn Diagram with these descriptors? Where, how, and why? Read orally from the Lesotho background Internet site, or download copies of the information and print them in advance for the class to complete this part of the activity. Have students add to or alter the Venn diagram to reflect the new descriptors.

4. Ask the first essential question again, "How do communities acquire water sources?" Mention that there are organizations in developing nations that assist communities in obtaining adequate water supplies. Ask students to brainstorm the process that a village or community in Lesotho, Africa would use to build and maintain a water system. Keep track of these ideas for future reference for the students. Announce that for the next few days the students will be involved in a unit that simulates the process of water supply acquisition in a village in Lesotho, Africa.

5. Ask the class to locate Lesotho on classroom map of Africa. Distribute the maps of Lesotho and have students use it to fill in the physical features of Lesotho. Have students use a search engine to find a topographical map of Lesotho on the Internet, or provide them with atlases to use to sketch in the physical features of Lesotho on their maps. Be sure they understand that they are completing this task so they can understand the difficulties in supplying water to individual villages and communities.

6. When they have a finished a rough topographical map of Lesotho, conduct a discussion about what they have learned. Point out the geographic regions of Lesotho, its mountains, and lowlands along with other physical features. Ask for comments about the ease of obtaining and transporting water in Lesotho.

7. For homework, have students gather further information on Lesotho. They can use the Internet search engine as they did earlier. Have them focus on the environment and health and the factors that influence both.

Procedure--Day Two

1. Discuss the homework assignment, asking students what they have learned about Lesotho. Be sure they understand that many of the men in villages in Lesotho find work in South Africa and therefore are not present in the community much of the time.

2. Divide the class into groups of four. These groups will be called Village Water Committees (WVC). Provide each VWC with student attachment Bringing Water to a Lesotho Village. Have students read the hand-out to learn about the roles, the tasks, and background information about Lesotho that they may not already know.

3. Discuss the scenario. Lead students to understand that while this is a fictitious scenario,

the reality of Lesotho is that is a water wealthy country where villages lack access to adequate clean water supplies.

4. Discuss the work of each of the VWC roles—Spokesperson, Designer, Researcher, and Engineer—and answer any questions students may have. Make adjustments as necessary to meet the needs of your students, including alternating the roles daily if that is appropriate. Assign or have students choose their roles.

5. Distribute the VWC Research and Development Guide (VWCR&D).Walk students through the directions, pointing out the examples given. Let students know that the data collection will assist them in planning and designing their village's water supply system. Have each VWC begin research about Lesotho water sources from the Water in Africa site using the VWCR&D Guide.

6. Monitor the progress of the groups, assisting them as necessary to interpret and analyze the anecdotes on the Water in Africa site, and directing them to use all the resources available on the site, such as the diagrams and fact files.

7. A few minutes before the end of the period, ask students to give an assessment of what they have learned, and where they are in the research process. Answer any questions that may arise.

Procedure--Days Three and Four

1. Announce that each VWC should complete all research and data collection today and begin to develop a design of the water system they are promoting. Explain that they will be using the second and third pages of the VWCR&G Guide to plan their water supply system.

2. Distribute Examples of Water Acquisition Systems (PDF)and Water Supply Provision Process. Instruct the students that the Water Acquisition Systems are examples of what might be used in African countries. They may or not be appropriate for Lesotho, and the students must judge that for themselves. The other hand-out will assist them in understanding all that must be done by their VWC.

3. Remind the students that they should stay within their roles as committee members, and should start collaborating on their village water plan using the provided information as necessary, along with their data collection sheets.

4. Circulate among the groups monitoring the progress and assisting as necessary. Toward the end of the period, assess the groups' progress and cooperation.

Procedure--Day Five

1. Make sure that each VWC has completed its drawings, or models of the water supply system that the group is promoting. Committees may want to rehearse their presentations.

2. To create an appropriate atmosphere, arrange chairs or committees into a circle set-up the classroom as if the presentations were taking place in a Lesotho village schoolroom or in the village center. Have each committee make their presentation.

3. At the conclusion of the presentations, list each VWC name on the board. Ask students to list strengths and weaknesses of each plan. Consider the essential points of the plans as criteria. The water supply system that the committee proposes is more efficient than the present system. The health of the community will increase as a result of constructing this alternative system.

4. Ask the students to discuss the following questions: How well does each plan address the criteria? Can the VWC decide on any one plan that works best? Why or why not? What could a VWC do to make the plan better, or more feasible? Ask students what they would change to create a better plan ?

5. Continue the discussion by relating it to water systems in the United States. Ask students if their plans could be used by communities in the United States. What geographic regions (give examples) of the United States would benefit from anyone of the VWC's water supply plans? What plans would not work in a specific US geographic region? Why or why not?

Assessment

Assess the Venn Diagrams and VWC Research and Design Guides for completion and accuracy.

Use the Evaluation Rubric to assess the models that the groups have created.

Follow-up/Enrichment Activities

Have your students give their presentations to members of the local water board, or foreign students from Africa. Ask these groups of adults to comment on the models and advise students about the accuracy and appropriateness of the systems they have created.

Visit a local water supply and treatment facility. Learn where your own water originates and the process it goes through before arriving in your taps.

Hold mock interviews with village members on how their life has been affected by the new water system.

Create an alternative water supply system for your community. Assume it is 25 years into the future and the present system is inadequate.

Create a model of water well (or other water system) in a Lesotho village using research and data collected.

Additional Resources

www.africawater.org

About the Author

Dany M. Ray is a teacher for the gifted, grades 5-8 at Washington Middle School, Grady County School System, Cairo, Georgia. Dany describes the activities of her class as she piloted this lesson: "I piloted "Bringing Water to a Lesotho Village," with my seventh graders. They were really excited about the concept of being members of a village and being responsible for selecting, designing and creating a water supply system for their village. Students used the hand-outs to organize who would do what. We found the maps helpful throughout the data collection and research process. The kids were able to access them back and forth as they worked. The most exciting part of the lesson was facilitating as the village water groups reviewed data, illustrations, and background reading, and then began discussing the geography of the land, the tools available, and the materials needed. Of course, I had to bring them back to reality when they wanted to just helicopter in the pipe, cement, etc. for the project. I sent them back to the water site to study the infrastructure of Lesotho, and what would be reasonable. The final presentation had each group jockeying for approval of their water supply system.

Bringing Water to a Village in Lesotho
The Village Water Committee

Scenario: Your village's existing water supply situation warrants the construction of an alternative water supply. The World Bank will provide funds for the construction and the post-maintenance of the water supply system. Each member of your the committee will play a vital role in the planning, designing, and construction of the new water supply system. The water committee must gain the approval of the village consequently a presentation to your village peers is expected. Read over the role descriptions provided, and then decide which role each member of your Village Water Committee will play.

Descriptions and roles for the Village Water Committee (VWC)

The WVC roles should be taken based on student interests and strengths. Roles are:

VWC Spokesperson: This member oversees the water project, and is skilled in the art of consensus building. Works well with the team and gives encouraging words. Takes on whatever responsibility is needed from start to finish. Leads committee through presentation, checks final product to see if essential points are included. Helps committee to decide on a two-dimensional model or three-dimensional model for final presentation.

VWC Researcher: This member navigates the Web as others record data and discuss the project. Is able to extract information from the sources and apply it to the plan. Downloads any information needed for committee members.

VWC Designer: This member is responsible for drawing the water supply system and any other visuals needed for the oral presentation, s/he gathers materials for the drawings or model. Then creates the rough draft.

VWC Engineer: Knows what equipment and materials are needed for the construction of a water supply system for that particular geographic region, for example, lowlands, near stream, or highlands with snowmelt or snow run-off. Makes decisions on materials mentioned in scenario and/or water supply systems diagrams. Interprets diagrams and written descriptions provided on the construction of water systems.

Bringing Water to a Village in Lesotho
The Village Water Committee

Background information for VWC members: Most villagers get by day to day almost entirely from subsistence agriculture. Almost no one has income generating jobs (except the men who work as migrant labor in the South African mines). Most people available to the project are unable to provide skilled labor for the water project. A real conflict occurs when labor is needed, but work in the fields also needs to be done.

Men perform duties that generally are more physically challenging like digging trenches, excavating springs or tank sites, making shaped stones first by dislodging or breaking them off with pick axes and then shaping them with hammers and chisels, and transporting heavier pipes by hand. Women do things like collecting sand and water (usually in basins that they carry on top of their heads), shaping small "crushed" stone (used as aggregate in concrete) with hammers and chisels, and transporting smaller pipes by hand. One common task for boys is to collect packets of cement (50kg each) by strapping the bags to donkeys' backs and driving the donkeys back to the village.

The villagers provide shovels, pick-axes, hammers, and chisels. Tools like these are found in almost every household primarily because of the agrarian society. Sand found in streambeds and stone is found all over the place in natural outcroppings (or places where there was no topsoil left because of massive erosion).

Tasks of the Village Water Committee

1. Form a committee and reach consensus on the roles of each member.

2. Research existing water systems within the country of Lesotho. Use the data collection instrument and the country information for Lesotho on the Water in Africa site at http://www.peacecorps.gov/wws/water/africa/countries/lesotho/

3. Plan and design, an alternative water supply system for your village.

4. Present your design and plan persuasively to your village (classmates) convincing them to implement your plan.

Note: The feasibility of your plan should be based on two essential points.

- How the proposed alternative water supply is more efficient then the present water system.
- How the health of the community will increase over all due to this alternative system.

Bringing Water to a Village in Lesotho
VWC Research and Design Guide (VWCR&D)

Research Directions: Collect the data you will need to plan a water supply system from the Water in Africa Web site about Lesotho at www.peacecorps.gov/wws/water/africa/countries/lesotho. **An example is provided.**

Information Source	What is the water source?	How is water brought to the locations?	How is the water used?
Photo LE0401	Bore Hole	Young girls fetch it and carry it to school	Drinking, washing hands

What conclusions can you draw from the photos and stories of the Peace Corps Volunteers to answer the question "How do communities acquire water sources? Write your conclusion below. Continue your response on the back of this sheet if necessary.

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Bringing Water to a Village in Lesotho
VWC Research and Design Guide (VWCR&D)

Design Directions: Refer to your research and the hand-outs, ***Examples of Water Acquisition Systems***, and ***Summary of Water Supply Provision Process in Lesotho*** to develop a plan to bring water to your village in Lesotho. Make sure you also consult the diagrams on the Water in Africa Web Site at http://www.peacecorps.gov/wws/water/africa/resources/diagrams.html. You and your VWC must make big decisions regarding where the supply of water originates and how you get it to the village. Answer the questions below to help you make those decisions.

1. In what geographic region is your village located? (Check your topographical map.)

2. What is the name of your village? .

3. Where do you get your present supply of water? Does it run all year? What is its condition? Describe it.

4. After completing your research and reading about how your committee should proceed, what kind of system will you plan?

5. What materials will you need?

6. Where will you get the materials? How will you get them?

7. What is the purpose of your system?

8. Give an example of a similar system that you found through your research.

9. How is your system different from the system presently used?

10. How will it effect the overall health of the village?

11. How is it different from what a rural/urban community in the United States would have.

12. Give a written description of the water supply system you will present to the village. Include drawings, diagrams, models, etc.

Bringing Water to a Village in Lesotho
Water Supply Provision Process

Pre-Construction

1. Village submits application for water supply system to **Lesotho Department of Rural Water Supply (DRWS).**
2. A **Village Liaison Officer (VLO)** from DRWS visits the village. The VLO carries out the following activities with the village:
   a. S/he documents the village's existing water supply situation and the village's level of desire to work to build and maintain a water supply system.
   b. S/he talks with the village about what DRWS can do to help them improve their water supply situation.
   c. S/he helps them to organize a **Village Water Committee (VWC)** that will oversee the construction and post-construction maintenance of the water supply system.
   d. S/he begins taking flow measurements from all water sources around the village (usually springs).
3. DRWS makes a priority list for villages to work with and when a village is chosen, **a Senior Technical Officer (STO)** from DRWS visits the village. The STO carries out the following activities with the village:
   a. S/he explains which water sources can be used in a new water supply system based on the flow measurements taken by the VLO and the general guidelines for how water supply systems can be constructed according to DRWS standards.
   b. S/he performs a survey with the VWC. They start at the spring and decide where the pipeline will run and where the various structures (sedimentation tank, storage tank, tap stands (spigots), etc.) will be located.
   c. S/he takes the survey information back to the DRWS office and draws a design of the water supply system using DRWS's format. The design is reviewed by DRWS engineers and if it is acceptable, construction of the system can commence.

Construction

1. DRWS delivers materials that cannot be found naturally around the village (i.e. pipes, cement, etc.) to a point as close to the village as they can get with their delivery trucks. The villagers then collect the materials from that point and set up a storage site in the village.
2. When the village has collected the majority of their materials, a skilled builder from DRWS moves into the village to begin construction of the water system.
3. The builder teaches the villagers how to perform several tasks that will complete the preparation for construction. These tasks are:
   a. To excavate the spring back to a point where the water is coming out of the ground at a single distinct point (called the eye of the spring).
   b. To shape stones found near the village so that they can be used to construct stone masonry water tanks.
   c. To collect sand that can be used in the concrete/mortar mixes.
   d. To dig trenches so that the pipeline can be buried.

4. The builder splits his time between supervising the villagers' unskilled labor operations and actually constructing the water system. The steps in actually building the water system are:
   a. First, the builder places a pipe right at the eye of the spring to catch the water coming from the spring and then makes a concrete protection around the pipe and the spring so that all of the water is channeled into the pipe.
   b. Then the builder constructs a small sedimentation tank in close proximity to the spring. All structures are constructed from stone masonry.
   c. Next the builder constructs a storage tank somewhere near the village that will collect water during periods of low demand each day.
   d. The builder then constructs tap stands at different locations throughout the village.
   e. Finally, the builder connects the pipe coming from the spring to the sedimentation tank; pipe is laid in the trench between the sedimentation tank and the storage tank; and pipe is laid in trenches between the storage tank and each of the tap stands in the village.
   f. After all pipes are connected and construction is finished, an engineer from DRWS inspects the system. If s/he approves of the construction, the villagers cover the protected spring with soil and backfill all of the pipeline trenches.

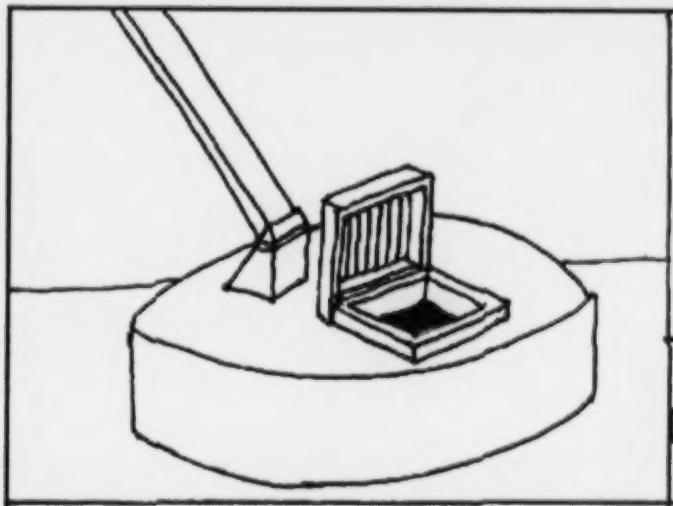
Post-Construction

1. During construction of the water system, one of the members of the VWC that was chosen to be the "Water Minder" works with the builder. The builder teaches him or her the function of each of the components of the water system and how to perform routine maintenance tasks. From the point when the DRWS engineer approves of the construction of the system and the builder moves out of the village, the Water Minder is responsible for all such routine maintenance of the water system.

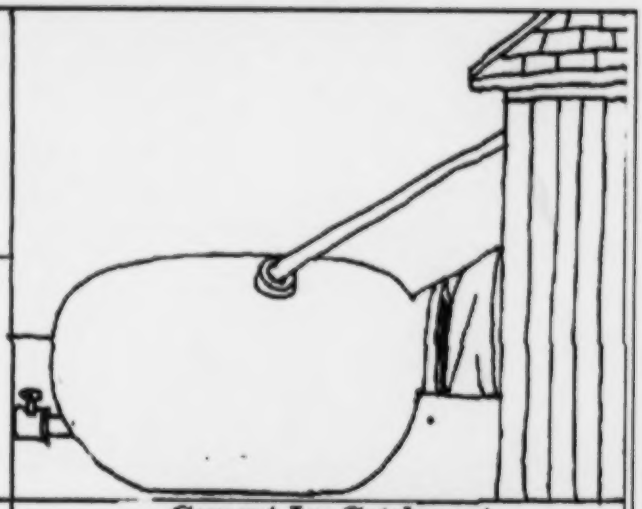
2. If any maintenance problems arise that the Water Minder cannot handle, an application for maintenance of the system is submitted to DRWS. DRWS prioritizes its maintenance requests and the village must pay for any work that DRWS does.

Adapted and used with Permission from Eric Giddens, PCV Lesotho 1997-1999

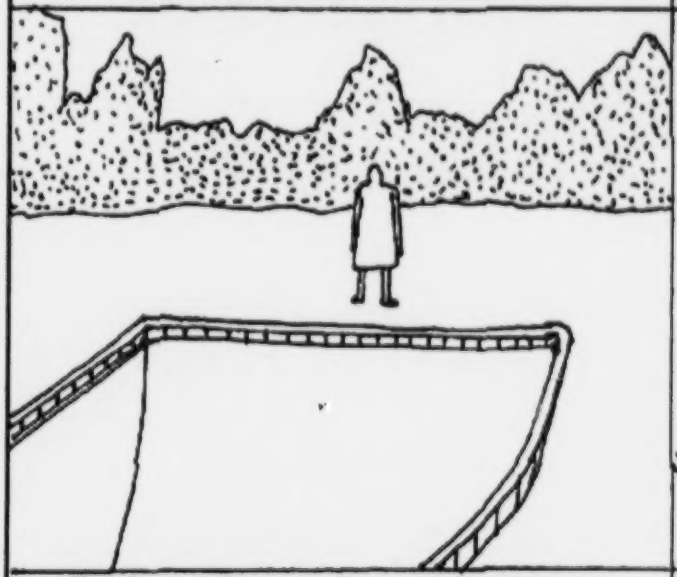
Examples of Water Acquisition Systems



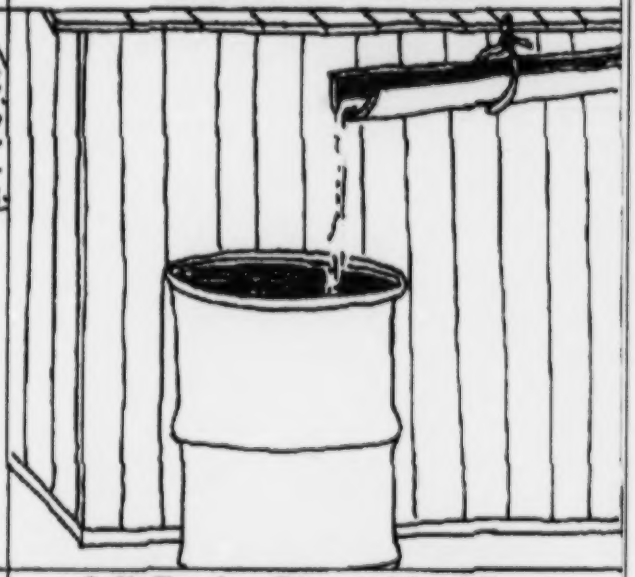
In-Ground Cement Cistern



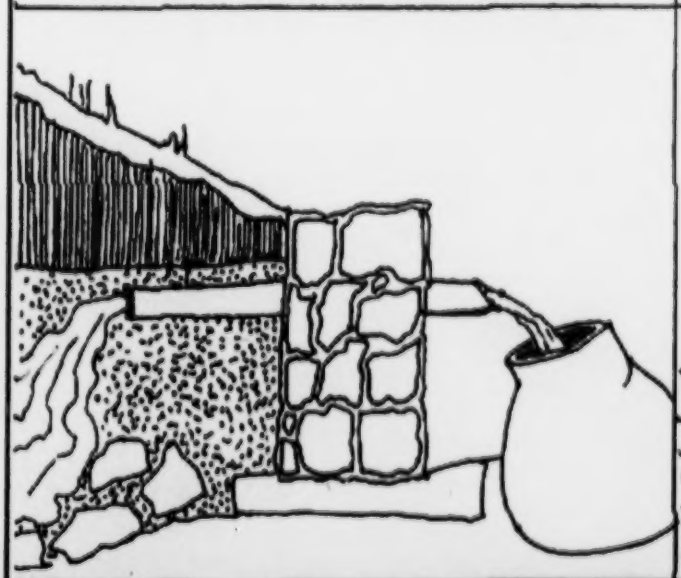
Cement Jar Catchment



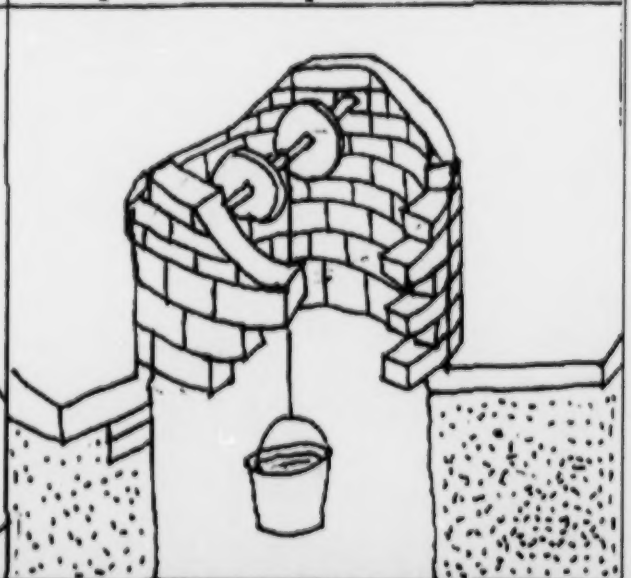
Brick and Cement Ground Catchment



Split Bamboo Pipe and Steel Drum



Bore Hole to a Spring with a Retaining Wall



Simple Pulley Well

Evaluation of Water Supply System

VWC Name_____

Student Names _____

Area	Points	Descriptors
Content Accuracy	**/30**	The students: • Used Venn Diagrams to compare and contrast urban and rural communities, U.S. communities and Lesotho, villages. • Chose content from their research that was pertinent and used it appropriately in planning the water system. • Presented a viable product that represented a water supply plan.
Content Depth	**/30**	The students: • Displayed and understanding of how human induced changes in the physical environment (a water supply system) can cause changes in other places. • Displayed and understanding of how human systems (a water supply system) develop in response to conditions in the physical environment. • Communicated how environmental factors (water) within a community influence that community's health.
Process	**/10**	The students: • Used cooperative and collaborative skills to gain access to data and diagrams, assumed assigned roles and stayed in character. • Were able to efficiently interpret information and transfer it to a product format as stated in village roles.
Presentation and Neatness	**/20**	The students: • Spoke clearly and confidently during the persuasive presentation. • Used visual aids or models to enhance the presentation.
Creativity	**/10**	The students: • Employed creative thinking in planning and presenting their water supply systems
Total	**/100**	

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